

What is Claimed Is:

1. An ophthalmic dispenser comprising:

a body defining a fluid reservoir;

a pump coupled in fluid communication with the reservoir and including a slide defining

5 an axially-elongated passageway and a piston slidably received within the axially-elongated

passageway, wherein the slide defines within the axially-elongated passageway a compression

zone, a first portion formed between the compression zone and the reservoir, and a second portion

located on an opposite side of the compression zone relative to the first portion, wherein the first

portion is defined by a first radius and the compression zone is defined by a second radius that is

10 less than the first radius, and at least one of the piston and slide is movable relative to the other

between (i) a first actuated position with the tip of the piston received within the first portion of

the slide, and the compression zone coupled in fluid communication with the reservoir for

receiving fluid therefrom, and (ii) a rest position with a tip of the piston received within the second

portion of the slide;

15 a nozzle comprising a valve including an annular, axially-extending valve seat, an outlet

aperture coupled in fluid communication between the valve seat and the compression zone, and a

flexible valve cover extending about the valve seat and forming an annular, axially-extending

interface therebetween, wherein the interface is connectable in fluid communication with the

outlet aperture, and at least part of the valve cover is movable between (i) a normally closed

20 position with the valve cover engaging the valve seat to close the interface and form a fluid-tight

seal therebetween, and (ii) an open position with at least part of the valve cover spaced away from

the valve seat in response to fluid flowing through the outlet aperture at a pressure greater than a

valve opening pressure to allow the passage of pressurized fluid therebetween; and

at least one spring drivingly connected to at least one of the piston and slide, wherein the spring drives at least one of the piston and the slide from the first actuated position to the rest position to pressurize fluid in the compression zone and, in turn, dispense a metered dosage of fluid through the valve and into a user's eye.

5 2. An ophthalmic dispenser as defined in claim 1, further comprising an actuator drivingly connected to at least one of the piston and slide for moving at least one of the piston and slide from the rest position to the first actuated position.

 3. An ophthalmic dispenser as defined in claim 1, wherein the pump defines an elongated axis, and the actuator defines a path of movement transverse to the elongated axis of the
10 pump.

 4. An ophthalmic dispenser as defined in claim 2, wherein the actuator includes a trigger, and a lever arm drivingly connected between the trigger and at least one of the piston and slide for moving at least one of the piston and slide from the rest position to the first actuated position in response to movement of the trigger.

15 5. An ophthalmic dispenser as defined in claim 4, wherein the spring is formed integral with the lever arm.

 6. An ophthalmic dispenser as defined in claim 5, wherein the spring is defined by a curvilinear end portion of the lever arm that engages the body for moving the body and, in turn, at least one of the piston and slide from the first actuated position to the rest position.

20 7. An ophthalmic dispenser as defined in claim 1, wherein one of the piston tip and the compression zone of the slide is softer than the other, and the piston tip and compression zone form an interference fit to thereby form a fluid-tight seal therebetween.

8. An ophthalmic dispenser as defined in claim 1, wherein the volume of the compression zone is approximately equal to the volume of the metered dosage of fluid dispensed through the valve.

9. An ophthalmic dispenser as defined in claim 1, wherein in the rest position the piston tip is located in the second portion of the slide and the outlet aperture is coupled in fluid communication with the reservoir to reduce the pressure between the outlet aperture and the compression zone and allow closure of the valve.

10. An ophthalmic dispenser as defined in claim 1, wherein at least one of the piston and the slide is movable relative to the other between (i) the rest position with the piston tip located in the second portion of the slide; (ii) the first actuated position with the piston tip located in the first portion of the slide and the compression zone coupled in fluid communication with the reservoir for receiving fluid therefrom; (iii) a second actuated position with the piston tip located in the compression zone, a fluid tight seal formed between the piston tip and compression zone to pressurize the fluid in the compression zone to a pressure greater than the valve opening pressure and, in turn, cause the pressurized fluid to open the valve and dispense through the valve; and (iv) the rest position with the piston tip located in the second portion of the slide and the outlet aperture coupled in fluid communication with the reservoir to reduce the pressure between the outlet aperture and the compression zone and allow closure of the valve.

11. An ophthalmic dispenser as defined in claim 1, wherein the nozzle defines a stop surface that contacts the piston tip in the rest position, and the surfaces of the piston tip and stop surface cooperate to define substantially zero volume within the second portion of the slide when the piston tip is in the rest position.

12. An ophthalmic dispenser as defined in claim 1, wherein the stop surface defines a first morphology, and the piston tip defines a second morphology substantially conforming to the first morphology.

13. An ophthalmic dispenser as defined in claim 12, wherein the nozzle defines a
5 single, angularly extending outlet aperture.

14. An ophthalmic dispenser as defined in claim 13, further comprising an eyelid depressor for engaging the facial tissue adjacent to an eye and lowering the eyelid to expose the ocular cul-de-sac upon delivering a metered dosage thereto, and wherein the outlet aperture of the nozzle is aligned with the eyelid depressor for delivering the metered dosage to the exposed ocular
10 cul-de-sac.

15. An ophthalmic dispenser for dispensing a fluid, the dispenser comprising:
a housing;
a first actuator coupled to the housing;
a self contained cartridge comprising:
15 a vial, the vial including an interior fluid receiving chamber defined therein;
a pump in fluid communication with the fluid receiving chamber for pumping a fluid received therein from the dispenser;
a nozzle disposed in fluid communication with the pump for allowing the passage of the pumped fluid therethrough;
20 a casing that retains the nozzle, the pump, and the vial arranged in that order along a longitudinal axis moving in a direction toward a posterior end of the dispenser, the casing having an anterior wall with an aperture for receiving the nozzle; and

a second actuator coupled to the casing and responsive to the first actuator, the second actuator having at least a portion disposed outside the casing and at least a portion disposed internal to the casing and operatively coupled to at least one of the pump and the vial, wherein in a first phase of actuation of the actuator, at least one of the pump and the vial moves along the longitudinal axis in a direction toward the other, and in a second phase of actuation by the actuator, at least one of the pump and the vial moves in a direction away from the other.

16. An ophthalmic dispenser as defined in claim 15, wherein the cartridge includes two main portions that are integrally formed and joined to one another to form the casing.

17. An ophthalmic dispenser as defined in claim 15, wherein the second actuator has a first end and a second end, the first end being pivotably mounted to the casing, the second end being operatively coupled to the pump, the actuator further having a pivot disposed between the first end and the second end.

18. An ophthalmic dispenser as defined in claim 15, wherein the casing further has a longitudinally extending portion having an inner surface that is substantially conformal with a longitudinally extending portion of the vial.

19. An ophthalmic dispenser as defined in claim 15, wherein the vial, pump and the nozzle form part of a fluid storage and delivery system, the fluid storage and delivery system having an outer envelope defining a shape, and wherein the casing has an outer envelope defining a shape that is substantially the same as the shape defined by the outer envelope of the fluid storage and delivery system.

20. A method comprising:
providing a plurality of cartridges for storing and dispensing an ophthalmic fluid, the plurality of cartridges being substantially identical to one another and each having a vial, a pump,

and a nozzle, the vial including an interior fluid receiving chamber defined therein, the pump being in fluid communication with the fluid receiving chamber for pumping a fluid received therein from the cartridge, the nozzle being disposed in fluid communication with the pump for allowing the passage of the pumped fluid therethrough, the cartridge further having a casing that
5 retains the nozzle, the pump, and the vial arranged in that order along a longitudinal axis moving in a direction toward a posterior end of the cartridge, and an actuator operatively coupled to the pump;

installing at least one of the plurality of cartridges in an ophthalmic dispenser having an actuator to operatively couple to the cartridge, wherein actuation of the actuator initiates
10 dispensing ; and

using at least one of the cartridges to dispense ophthalmic fluid without installing the cartridge in an ophthalmic dispenser having an actuator to operatively couple to the cartridge.

21. A method comprising:

providing a plurality of cartridges for storing and dispensing an ophthalmic fluid, the
15 plurality of cartridges being substantially identical to one another and each having a vial, a pump, and a nozzle, the vial including an interior fluid receiving chamber defined therein, the pump being in fluid communication with the fluid receiving chamber for pumping a fluid received therein from the cartridge, the nozzle being disposed in fluid communication with the pump for allowing the passage of the pumped fluid therethrough, the cartridge further having a casing that
20 retains the nozzle, the pump, and the vial arranged in that order along a longitudinal axis moving in a direction toward a posterior end of the cartridge, and an actuator operatively coupled to the pump;

providing a plurality of dispensers adapted to receive and operate the cartridges, the

plurality of cartridges being substantially identical to one another and being capable of operation as a stand alone unit or in the dispenser;

selling at least one of the cartridges in combination with at least one of the dispensers; and

selling at least one of the cartridges without a dispenser.

5 22. An ophthalmic dispenser for dispensing a fluid, the dispenser comprising:

a self contained replaceable cartridge having:

a posterior portion including a vial, the vial including an interior fluid receiving chamber defined therein;

10 a pump in fluid communication with the fluid receiving chamber for pumping an ophthalmic fluid received therein from the dispenser;

a nozzle disposed in fluid communication with the pump for allowing the passage of the pumped fluid therethrough;

15 a casing that retains the nozzle, the pump, and the posterior portion arranged in that order along a longitudinal axis moving in a direction toward a posterior end of the dispenser, the pump being operationally coupled to at least a portion of the posterior portion to move along the longitudinal axis in concert with movement of said at least a portion of the posterior portion along said axis, the casing having an anterior wall with an aperture for receiving the nozzle; and

20 an actuator operatively coupled to the at least a portion of the posterior portion, wherein in a first phase of actuation, the actuator moves the at least a portion of the posterior portion along the longitudinal axis in a direction toward the posterior end of the casing and thereby causes the pump to move in the same direction, and in a second phase of actuation, the posterior portion moves along the longitudinal axis in a direction toward the anterior end of the casing and thereby causes the pump to move in a direction toward the anterior end of the casing.

23. An ophthalmic dispenser as defined in claim 22, wherein the cartridge has two main portions that are integrally formed and joined to one another to form the casing.

24. An ophthalmic dispenser as defined in claim 23, wherein the casing further has a longitudinally extending portion having an inner surface that is substantially conformal with a
5 longitudinally extending portion of the vial.

25. An ophthalmic dispenser as defined in claim 22, wherein the vial, pump and the nozzle form part of a fluid storage and delivery system, the fluid storage and delivery system having an outer envelope defining a shape, and wherein the casing has an outer envelope defining a shape that is substantially the same as the shape defined by the outer envelope of the fluid
10 storage and delivery system.

26. An ophthalmic dispenser for dispensing a fluid, the dispenser comprising:
a cartridge having:

a vial, the vial including an interior fluid receiving chamber defined therein;

a pump in fluid communication with the fluid receiving chamber for pumping an
15 ophthalmic fluid received therein from the dispenser;

a nozzle disposed in fluid communication with the pump for allowing the passage of the pumped fluid therethrough;

a spring portion disposed posterior to said interior fluid receiving chamber defined therein;

a casing that retains the nozzle, the pump, and the vial arranged in that order along a
20 longitudinal axis moving in a direction toward a posterior end of the dispenser, the casing having an anterior wall with an aperture for receiving the nozzle; and

an actuator operatively coupled to the pump, wherein in a first phase of actuation, the actuator causes the pump to move along the longitudinal axis in a direction toward the posterior

end of the casing thereby applying force to the interior fluid receiving chamber and compressing the spring, and in a second phase of actuation, the compressed spring applies a force to help propel the pump in a direction toward the anterior end of the casing.

27. An ophthalmic dispenser for dispensing a fluid, the dispenser comprising:

5 a self contained replaceable cartridge having:

a vial, the vial including an interior fluid receiving chamber defined therein;

a pump in fluid communication with the fluid receiving chamber for pumping an
ophthalmic fluid received therein from the dispenser;

10 a nozzle disposed in fluid communication with the pump for allowing the passage of the
pumped fluid therethrough;

a casing that retains the nozzle, the pump, and the vial arranged in that order along a longitudinal axis moving in a direction toward a posterior end of the dispenser, the casing having an anterior wall with an aperture for receiving the nozzle; and

15 an actuator having a first end and a second end, the first end being pivotably mounted to
the casing, the second end being operatively coupled to the pump, the actuator further having a pivoting portion disposed between the first end and the second end.

28. An ophthalmic dispenser as defined in claim 27, wherein the cartridge has two main portions that are integrally formed and joined to one another to form the casing.

29. An ophthalmic dispenser as defined in claim 28, wherein the casing further has
20 a longitudinally extending portion having an inner surface that is substantially conformal with a longitudinally extending portion of the vial.

30. An ophthalmic dispenser as defined in claim 27, wherein the vial, pump and the nozzle form part of a fluid storage and delivery system, the fluid storage and delivery system

having an outer envelope defining a shape, and wherein the casing has an outer envelope defining a shape that is substantially the same as the shape defined by the outer envelope of the fluid storage and delivery system.

31. An ophthalmic dispenser comprising:

5 first means for forming a fluid reservoir;

a pump coupled in fluid communication with the reservoir and including an axially-elongated passageway and second means for pumping fluid within the axially-elongated passageway, wherein the pump defines within the axially-elongated passageway a compression zone, a first portion formed between the compression zone and the reservoir, and a second portion
10 located on an opposite side of the compression zone relative to the first portion, wherein the first portion is defined by a first dimension and the compression zone is defined by a second dimension that is less than the first dimension, and at least one of the second means and axially-elongated passageway is movable relative to the other between (i) a first actuated position wherein the second means is received within the first portion of the axially-elongated passageway, and the
15 compression zone is coupled in fluid communication with the reservoir for receiving fluid therefrom, and (ii) a rest position wherein the second means is received within the second portion of the axially-elongated passageway;

a nozzle comprising a valve including an annular, axially-extending valve seat, an outlet aperture coupled in fluid communication between the valve seat and the compression zone, and a
20 flexible valve cover extending about the valve seat and forming an annular, axially-extending interface therebetween, wherein the interface is connectable in fluid communication with the outlet aperture, and at least part of the valve cover is movable between (i) a normally closed position with the valve cover engaging the valve seat to close the interface and form a fluid-tight

seal therebetween, and (ii) an open position with at least part of the valve cover spaced away from the valve seat in response to fluid flowing through the outlet aperture at a pressure greater than a valve opening pressure to allow the passage of pressurized fluid therebetween; and

third means for biasing at least one of the second means and the axially-elongated passageway from the first actuated position to the rest position and, in turn, pressurizing fluid in the compression zone to dispense fluid through the valve and into a user's eye.

32. An ophthalmic dispenser as defined in claim 31, further comprising fourth means for actuating the pump and, in turn, moving at least one of the second means and axially-elongated passageway relative to the other.

33. An ophthalmic dispenser as defined in claim 32, wherein the pump defines an elongated axis, and the fourth means defines a path of movement transverse to the elongated axis of the pump.

34. An ophthalmic dispenser as defined in claim 31, wherein the fourth means includes a trigger, and a lever arm drivingly connected to at least one of the first means and the pump, wherein the lever arm is engageable by the trigger for moving at least one of the second means and axially-elongated passageway relative to the other.

35. An ophthalmic dispenser as defined in claim 34, wherein the lever arm defines at least one of (1) a flexible, curvilinear body that is flexibly movable radially and axially with movement of the trigger, and (2) a first arm portion, a second arm portion, and a living hinge flexibly connecting the first and second arm portions to each other and permitting radial and axial movement of the first and second arm portions with movement of the trigger.

36. An ophthalmic dispenser as defined in claim 31, further comprising an actuator drivingly connected to at least one of the first means and the pump, and defining the third means.

37. An ophthalmic dispenser as defined in claim 36, wherein the third means is defined by a flexible, curvilinear portion of the actuator engaging the first means for moving the first means and, in turn, at least one of the second means and axially-elongated passageway relative to the other.

5 38. An ophthalmic dispenser as defined in claim 31, further comprising an eyelid depressor engageable with the facial tissue adjacent to an eye for moving the tissue and, in turn, lowering the adjacent eyelid, and an actuator drivingly connected to both the eyelid depressor and at least one of the first means and the pump for substantially simultaneously actuating the eyelid depressor and the pump.

10 39. An ophthalmic dispenser as defined in claim 38, wherein the third means is formed by the actuator.

40. A method for filling an ophthalmic dispenser, the ophthalmic dispenser comprising a rigid housing defining a first fluid-receiving chamber, and a flange defining a second fluid-receiving chamber axially spaced relative to the first fluid receiving chamber and
15 connectable in fluid communication therewith; a flexible bladder defining an axially-extending body portion receivable within the first fluid-receiving chamber of the housing, a first annular sealing surface, and a second annular sealing surface axially spaced on an opposite side of the first annular sealing surface relative to the axially-extending body portion and receivable within the flange of the housing; a pump coupled in fluid communication with the first fluid-receiving
20 chamber; a nozzle comprising a valve including an annular, axially-extending valve seat, an outlet aperture coupled in fluid communication between the valve seat and the pump, and a flexible valve cover extending about the valve seat and forming an annular, axially-extending interface therebetween, wherein the interface is connectable in fluid communication with the outlet

aperture, and at least part of the valve cover is movable between (i) a normally closed position with the valve cover engaging the valve seat to close the interface and form a fluid-tight seal therebetween, and (ii) an open position with at least part of the valve cover spaced away from the valve seat in response to fluid flowing through the outlet aperture at a pressure greater than a valve opening pressure to allow the passage of pressurized fluid therebetween; and at least one spring drivingly connected to at least one of the pump and housing, wherein the spring moves at least one of the pump and housing relative to the other to actuate the pump, the method comprising the steps of:

(i) introducing an ophthalmic fluid into at least the first fluid-receiving chamber of the housing;

(ii) inserting the axially-elongated body portion of the flexible bladder at least partially into the first fluid-receiving chamber of the housing such that the first fluid receiving chamber is filled with ophthalmic fluid and at least part of the second fluid-receiving chamber is filled with ophthalmic fluid; and

(iii) forming a first substantially fluid-tight seal between the first annular sealing surface of the bladder and the housing, forming a second substantially fluid-tight seal between the second annular sealing surface of the bladder and the flange of the housing such that the first fluid-receiving chamber is filled with ophthalmic fluid substantially without any gas therein, and the second fluid-receiving chamber is at least partially filled with ophthalmic fluid.

41. A method as defined in claim 40, further comprising the step of collapsing the flexible bladder prior to inserting the bladder into the first fluid-receiving chamber of the housing.